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Screening of some chickpea genotypes against *Helicoverpa armigera* on the basis of physical parameters grown at two locations of Bangladesh

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Abstract: Experiments on chickpea genotypes and varieties (CPC-814, CPC-830, CPM-825, CPM-860, BARIsola-3 and Binasola-4) were conducted at two locations (Magura and Nachole) of Bangladesh under pesticide free open field conditions to screen out against pod borer on the basis of physical parameters. The mean pod damage among the test entries ranged from 8.3-15.2% in Magura and 13.9-16.6% in Nachole. The physical characteristics i.e. number of branches plant^{-1} , number of leaves branch^{-1}, number of pods plant^{-1}, number of infested pods plant^{-1}, hundred seed weight (g), grain yield (t ha^{-1}), trichomes density cm^{-2} area of pod shell were recorded and analyzed. A significant positive relationship of pod borer infestation with the number of branches plant^{-1} and negative relationships were observed with the number of trichomes on pod shells and among the genotypes CPC-814 showed the best performance against pod borer.
Keywords: Chickpea, pod borer *(Helicoverpa armigera)*, physical parameter

Introduction

Chickpea has about 22% of protein content (Ahmed, 1984) with high level of limiting amino acid and as a low priced good protein source, has a great demand in Bangladesh. But the area and production of chickpea has remained constantly low because of many constrains including its susceptibility to different insect pests. Insect pest constitute an important biotic stress on plants and it is estimated about 13% of the crop is damaged by insects (Sethi, 1994). Chickpea is attacked by about 57 insect species in India and Indian sub-continent and about half a dozen of which are considered to be of economic significance. About 80-90% of the total pest damage is because of a single pest, the chickpea pod borer (*Helicoverpa armigera)(Reed et al.,1987).* To control this pest farmers use huge amount of pesticide but now-a-days they lost their interest about the uses of pesticide to control this pest because of its purity, high cost, development of resistance and also environmental pollution (Armes *et al.,* 1996). All the things have opened–up the avenues for identification and adoption of chickpea genotype(s), which is resistant or tolerant to *Helicoverpa armigera*. The resistant or tolerant genotype is the best or prefered component of integrated pest management (IPM). Under this situation the present study on the evaluation of chickpea mutants developed by BINA against pod borer on the basis of their some physical characters was conducted at two different locations of Bangladesh.

Materials and Methods

The experiments were conducted at BINA sub-station farm, Magura and farmer's field at Nachole, under the district of Chapainawabganj during October 2006 to March 2007. The experiment was laid out in a randomized complete block design with 3 replications at both the locations having plot size 3 m X 1.5 m. The chickpea seeds of two varieties (Binasola-4 and BARIsola-3), two mutants (CPM-825 and CPM-860) and two cultivars (CPC-814 and CPC-830) were sown in rows made by hand plough on 28 November 2006. The distance maintained between row-to-row and seed to seed were 30 cm and 15 cm, respectively. Seeds of all varieties, mutants and cultivars were collected from Bangladesh Institute of Nuclear Agriculture, Mymensingh. Germination test was done in the laboratory before sowing in the field. Different intercultural operations were accomplished as and when necessary for better growth and development of the plants. Seed and straw yield were recorded plot wise after drying and was calculated to t ha-1. The plots were harvested separately at the stage of 70-80% pod maturity stage. Before harvesting the crops at both the locations, 10 representative plant samples from each plot was collected separately, tagged properly and bought to the laboratory for studying the physical parameters like branches plant-1, leaves branch-1, pods plant-1, infested pods plant-1, 100 grain weight, trichomes density cm-2 area of pod shell and grain yield (t ha-1). The data were analyzed statistically by F-test (Gomez and Gomez, 1984). Analysis of variance was done with the help of computer package M-STAT developed by Russell (1986). The mean comparisons of the treatments were evaluated by DMRT.

Results and Discussion

The results of different physiological parameters of some genotypes and varieties, such as number of branches plant^{-1}, number of leaves branch^{-1}, number of pods plant^{-1}, number of infested pods plant^{-1}, percent pod infestation plant^{-1}, grain yield, per cent yield loss plant^{-1}. The data have been presented in the form of Tables and Figures.

A significant variation was observed in the number of branches plant^{-1} among the genotypes at Magura. The maximum number of branches plant^{-1} (9.10) was observed from the genotype CPM-825, which was identical with the number of branches (8.77), obtained from CPM-860 and Binasola-4 (8.00). The minimum number of branches plant^{-1} (5.53) was observed from the genotypes CPC-814, which was statistically similar to BARI-3 (6.53) and CPC-830 (5.73) but number of branches plant^{-1} did not show significant variation among the genotypes at Nachole which ranged from

4.80 to 5.47. The above variability in the number of branches is in partial agreement with Gupta *et al.* (1995). Pod borer infestation increased with the increased of branches plant^{-1} because it's make a plant bushy which increased the yield of biomass.

The number of leaves branch^{-1} of chickpea genotypes were measured after pod formation and the result has been presented in Table 1. The results indicate that there were no significant variations of leaves among the chickpea genotypes at Magura and the number of leaves branch^{-1} ranged from 20.60 to 22.73. But at Nachole the maximum number of leaves branch^{-1} (23.57) was observed from the genotype CPC-814, which was statistically similar to CPC-830 (22.83). The lowest number of leaves branch^{-1} (20.08) was recorded from the genotype CPM-825. All other genotypes were intermediate in producing number of leaves branch^{-1}.

Table 1. Different physiological parameters of some chickpea genotypes and varieties grown at two locations of Bangladesh

Chickpea genotypes and varieties	Magura			Nachole		
	Branches plant^{-1} (no.)	Leaves branch^{-1} (no.)	Pods plant^{-1} (no.)	Branches plant^{-1} (no.)	Leaves branch^{-1} (no.)	Pods plant^{-1} (no.)
CPC-830	5.73c	22.00	53.83	4.83	22.83ab	42.00
CPM-860	8.77a	20.80	50.47	5.47	21.38c	43.30
CPC-814	5.53 c	22.73	34.27	4.80	23.57a	36.33
BARIsola-3	6.53bc	21.62	37.93	4.97	22.10bc	36.47
CPM-825	9.10a	20.60	29.03	5.40	20.08d	29.60
Binasola-4	8.00ab	20.96	46.13	5.33	21.98bc	32.10
S_x	0.422	0.645	6.618	0.568	0.264	4.00

In a column, means followed by a common letter do not differ significantly at 5% level by DMRT.

Pods plant^{-1} is the most important yield attributing character of chickpea plant. The results show that there were no statistical variations of pod contents among the genotypes of chickpea at both the locations (Magura and Nachole) compared with the check variety BARIsola-3 and Binasola-4 (Table 1). The total number of pods plant^{-1} among the genotypes ranged from 29.03-53.83 in Magura and 29.60-43.30 in Nachole. These results are supported by Ashewar *et al*. (2003).

In case of pod infestation it was observed that the highest per cent pod infestations plant^{-1} occurred in CPM-825 (15.21% at Magura & 16.64% at Nachole) and then CPM-860 (13.46% at Magura & 15.52% at Nachole) and the minimum per cent pod infestations plant^{-1} observed from CPC-814 (8.32% at Magura & 13.94% at Nachole), which was statistically similar to the check variety BARIsola-3 (4.29% & 10.31%) and Binasola-4 (6.35% & 11.37%) at Magura and Nachole, respectively(table-2).Similar studies were also done by Mandal, (2003) and reported that pod damage varied from 9.43 to 24.80%.

100 grain weight of chickpea genotypes and varieties significantly varied at both the locations (Table 2). The heighest 100 grain weight (26.33 g and 26.27 g) was obtained from the genotype CPM-860 at Magura and Nachole, respectively. The lowest 100 grain weight (10.83 g and 11.02 g) was observed from the genotype CPM-825 at Magura and Nachole, respectively. These results are supported by Gupta *et al*. (1996).

The number of trichome cm^{-2} of pod shell have been presented in Table 2 and significant variations among the genotypes observed at both the locations (Magura and Nachole). The highest number of trichome (224.43 & 245.56) cm^{-2} area of pod shell were obtained from CPC-814 at both the locations and it was statistically similar to the check variety BARIsola-3 (239.88 & 292.33) and Binasola-4 (234.43 & 258.81). The lowest number (182.22 & 208.87) of trichome cm^{-2} area of pod shell was obtained from CPM-825 both at Magura and Nachole.

Table 2 Number of infested pods plant^{-1}, 100 seed weight and yield loss plant^{-1} of some chickpea genotypes and varieties grown at two locations of Bangladesh

Chickpea genotypes and varieties	Magura			Nachole		
	Infested pods plant^{-1} (%)	100 grain weight (g)	Trichomes cm^{-2} area of pod shell (no.)	Infested pods plant^{-1} (%)	100 grain wt. (g)	Trichomes cm^{-2} area of pod shell (no.)
CPC-830	12.35ab	15.37d	189.97b	14.22ab	15.55d	221.43b
CPM-860	13.46ab	26.33a	186.66b	15.52a	26.27a	235.55b
CPC-814	8.32abc	20.68b	224.43a	13.94ab	20.88b	245.56ab
BARIsola-3	4.29c	19.53c	239.88a	10.31b	19.53c	292.33a
CPM-825	15.21a	10.83f	182.22b	16.64a	11.02f	208.87b
Binasola-4	6.35bc	12.73e	234.43a	11.37b	12.97e	258.81ab
S_x	0.724	0.162	5.815	0.726	0171.	10.872

In a column, means followed by a common letter did not differ significantly at 5% level by DMRT.

The degree of relationship between number of trichomes on pod shell and percent infestation of chickpea by chickpea pod borer was studied (Fig.1). Result reveales that number of trichomes and per cent pod borer infestation had a significant negative relationship, which had been confirmed with correlation (r=0.249) and the regression line of Y (number of trichomes cm^{-2}) on X (percent infestation) (Y=-0.032x+19.079). The negative slope indicated a negative relationship.

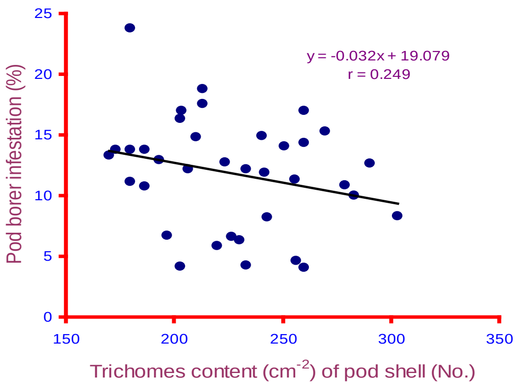

Fig.1 Relationship between trichome density on pod shell and pod borer infestation of chickpea.

The presence of trichomes (their type, orientation, density and length) and their exudates on pod wall surface play an important role in the ovipositional behaviour and host selection process of insect herbivores and trichomes on pod shell negatively correlated with oviposition and larval population of pod borer (Khan *et al*. 2005, Aruna *et al.* 2005).

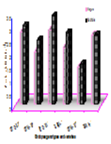

Fig. 2 Grain yield of some chickpea genotypes and varieties grown at two locations of Bangladesh

Grain yield (Fig.2) showed significant variations among the chickpea genotypes at both the locations. The maximum grain yield (2.84 t ha^{-1} at Magura and 3.364 t ha^{-1} at Nachole) was obtained from the genotype CPC-814, which was statistically identical to the genotype CPC-830 (2.77 t ha^{-1} at Magura and 3.01 t ha^{-1} at Nachole) and the lowest grain yield (1.42 t ha^{-1} at Magura and 1.54 t ha^{-1}at Nachole) was obtained from the genotype CPM-825.

It could be concluded that no chickpea genotypes or varieties were 100 % resistant against pod borer infestations and the pod infestations of chickpea by chickpea pod borer had a positive correlation with number of branches $plant^{-1}$ but a negative relationship with trichome density cm^{-2} area of pod shells. CPC-814 comparatively showed the best performance among the test entries irrespective of grain yield, infestation, trichomes density on pod surface and other parameters. Further studies with more chickpea genotypes and varieties at different locations of Bangladesh should be under taken to confer the results.

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